IPETRONIK

IPEMOTION
Software

NI-DAQmx PlugIn

September 2013

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1 Important and general information

1.1 Important information

Please follow these instructions before and during the use and application on any IPETRONIK product!

1.1.1 Safety and Warning instructions

Please follow the instructions **and** information as contained in the user manual!

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   - Communication with the vehicle's control units (ECUs), especially with such of the brake system and/or of the engine and transmission control (power train control system).
   - Installation of components for remote data transmission (mobiles, GSM/GPRS modems, WiFi and Bluetooth components).
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1.2 General information

1.2.1 About this manual

This manual describes how to use the NI-DAQmx PlugIn to build your data acquisistion applciation with IPEmotion.

1.2.2 Version

This manual has the version number V01, released 09.2013

1.2.3 Legend of used icons

Tip *This icon indicates a useful tip that facilitates the application of the software.*

Information *This icon indicates additional information for a better understanding.*

Attention! *This icon indicates important information to avoid potential error messages.*

1.2.4 Support

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CEOs: Erich Rudolf, Andreas Wocke

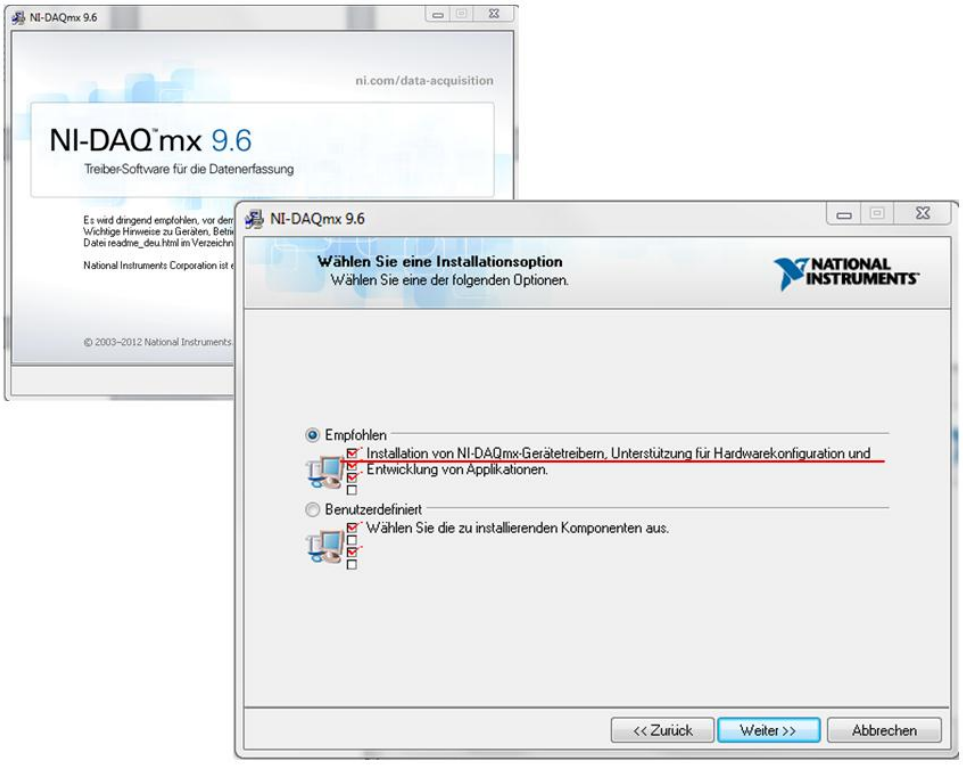
Technical support and product information

www.ipetronik.com e-mail: support@ipetronik.com

2 PlugIn Overview

2.1 NI-DAQmx driver installation

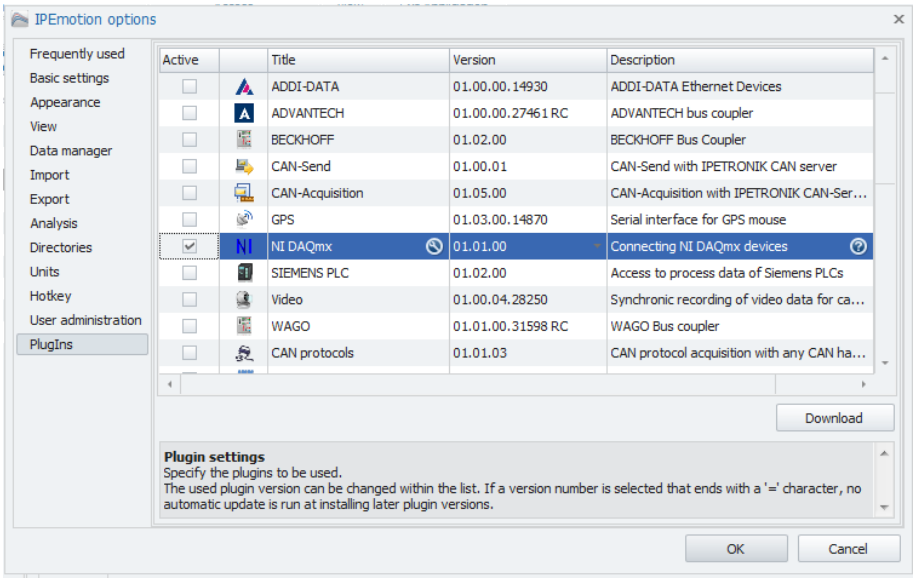
The Ni-DAQmx PlugIn requires the NI-DAQmx driver library of National Instruments. This library needs to be installed so that the devices are recognized correctly via the USB interface. The latest driver is hosted on the NI website. The NI-DAQmx device driver should be selected for installation.



After installation and connection of the device to the computer, the hardware is directly recognized in the “Devices and Printer” menu.

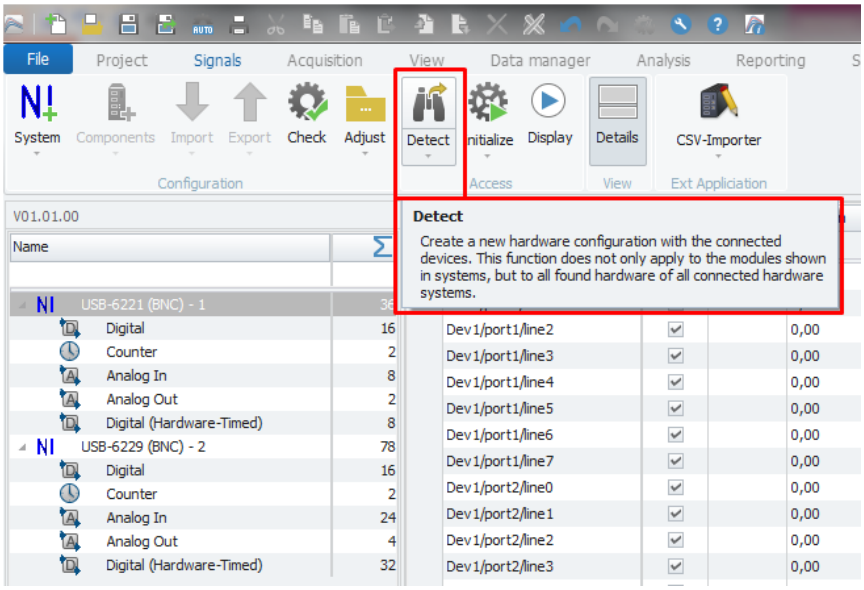
2.2 PlugIn installation

The NI-DAQmx PlugIn is hosted on the IPETRONIK website www.ipetronik.com. After having installed the PlugIn, you need to restart IPEmotion. A message window will notify you, telling that a new PlugIn was found. After activation, the PlugIn can be used for data acquisition. The PlugIns can be managed in the options of IPEmotion options.

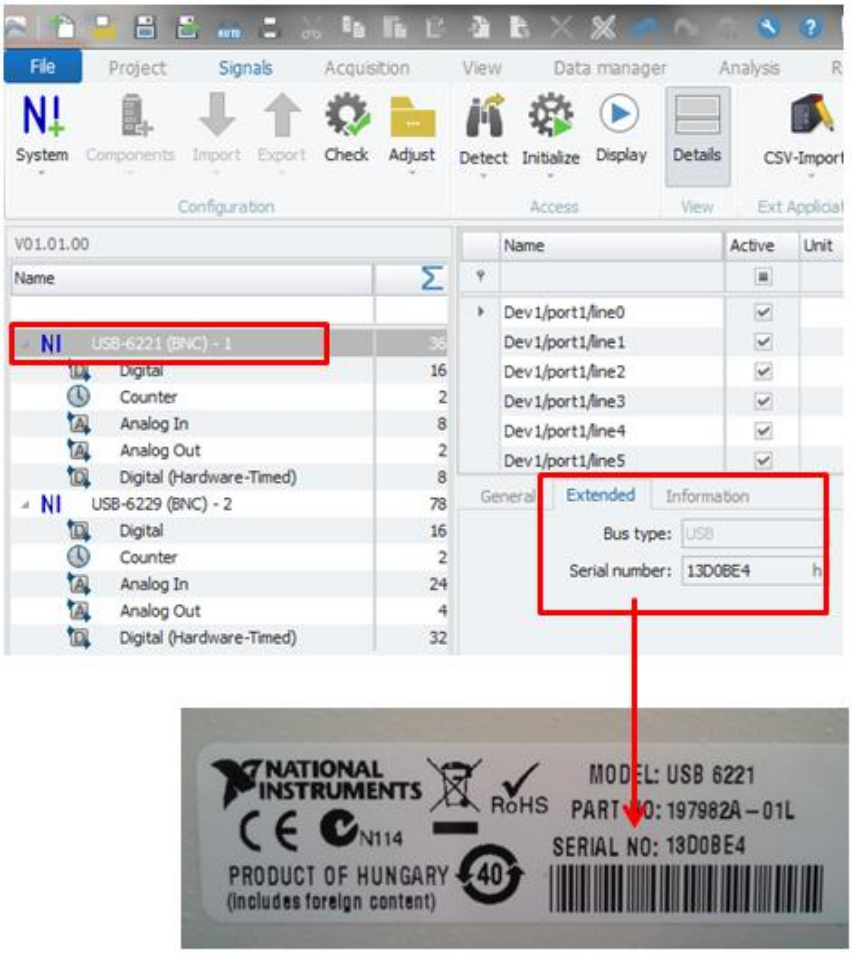


2.3 Hardware detection

IPEmotion provides functions for automatic hardware detection. Setting up communication between board and USB devices like the NI DAQmx family is very easy using automatic hardware detection.



In this example, 2 USB devices are connected to the computer. After detection, both systems with complete channel overview are generated. All the channels are grouped on signal type. On device level in the ***Extended*** tab sheet, the device serial number is indicated.

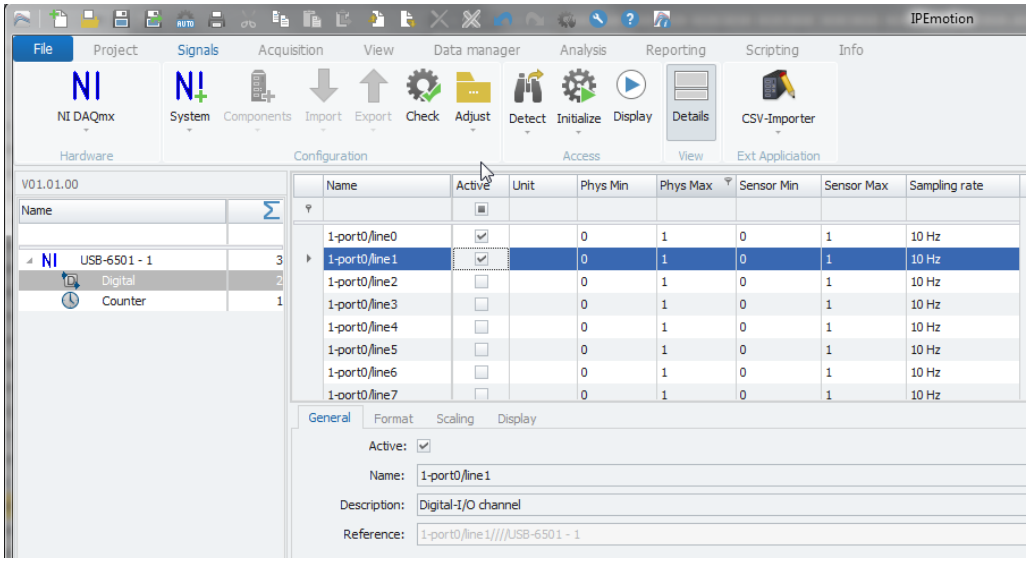

File
Project
Signals
Acquisition
View
Data manager
Analysis
System
Components
Import
Export
Check
Adjust
Detect
Initialize
Display
Details
CSV-Import
Configuration
Access
View
V01.01.00
Name
Active
Unit
NI USB-6221 (BNC) - 1
Digital
Counter
Analog In
Analog Out
Digital (Hardware-Timed)
NI USB-6229 (BNC) - 2
Dev1/port1/line0
Dev1/port1/line1
Dev1/port1/line2
Dev1/port1/line3
Dev1/port1/line4
Dev1/port1/line5
General
Extended
Information
Bus type: USB
Serial number: 13D0BE4
NATIONAL INSTRUMENTS
RoHS
MODEL: USB 6221
PART NO: 197982A-01L
SERIAL NO: 13D0BE4
N114
PRODUCT OF HUNGARY
(includes foreign content)
40

3 Device 6501

3.1 Device Overview

- 24 x digital I/O lines
- 1 x 32-bit counter

3.2 Digital Inputs / Outputs

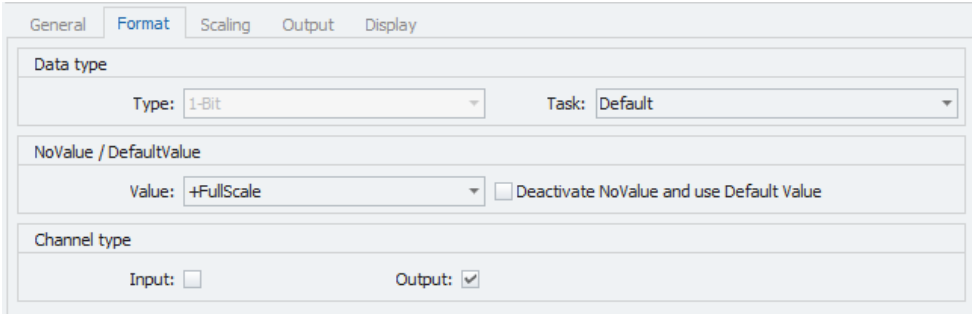


The digital inputs and outputs are software-timed channels, i.e. the data is periodically sampled by using a software timer. Analog to the software-timed counter, only sampling rates are accepted which can be converted into an even period duration (1000/Sampling rate).

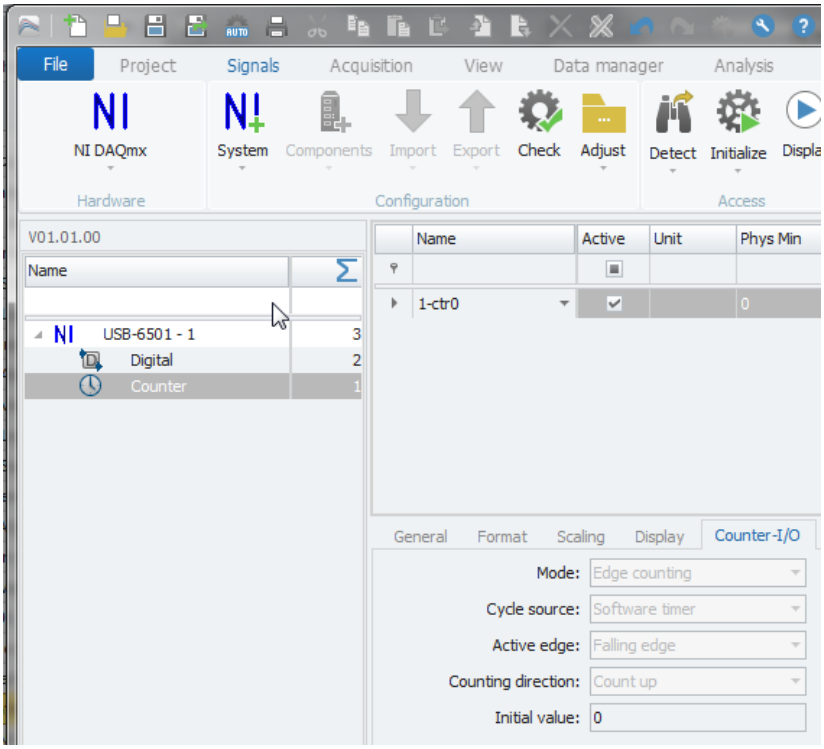
- The same sampling rate configured for one channel is automatically applied to all other digital inputs.

Defining Data direction:

- The Format tab defines the channel type as an input or output. This configuration defines whether the channel is operated as an input or output.



3.3 Counter Input



The 6501 module supports only software-timed counter. The software-timed counter uses a software timer based on the sampling rate for periodical data sampling. Because of working with a period duration, only sampling rates are accepted which can be converted into an even period duration (1000/Sampling rate).

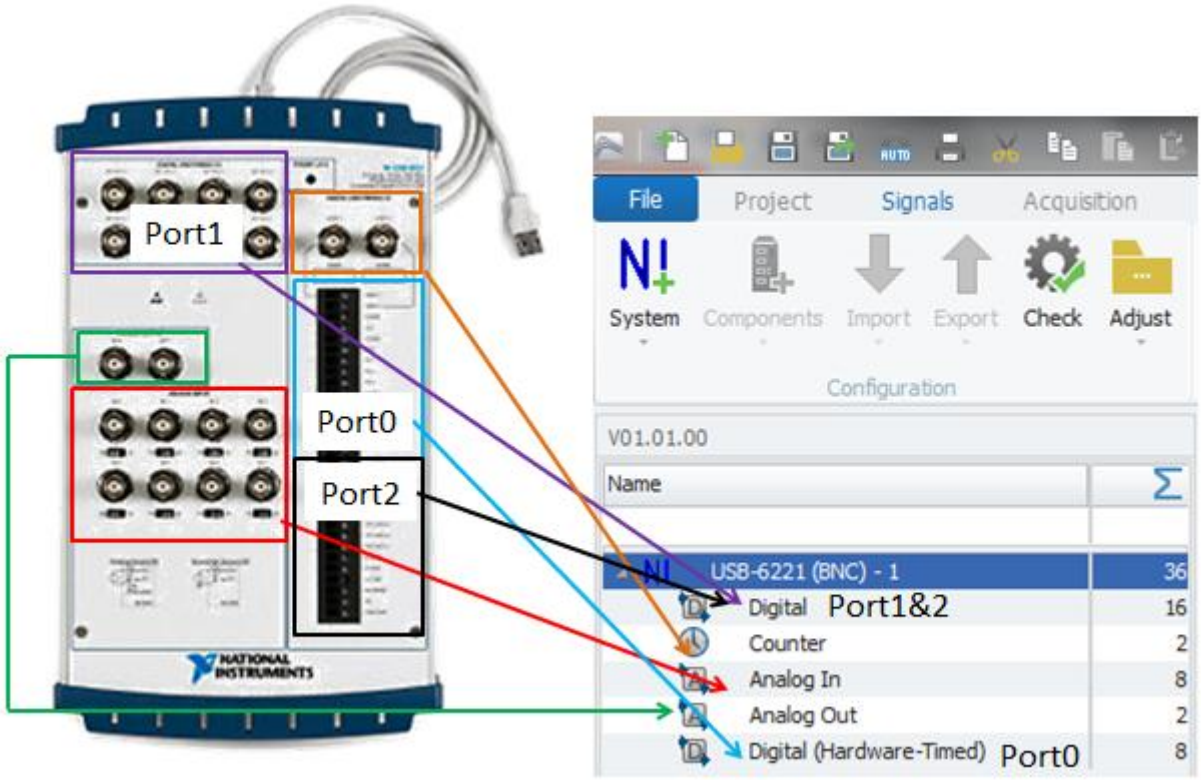
The other boards like USB-6221 or 6229 can have external cycle sources which will be discussed in the following chapters.

4 Devices BNC 6221 and BNC 6229

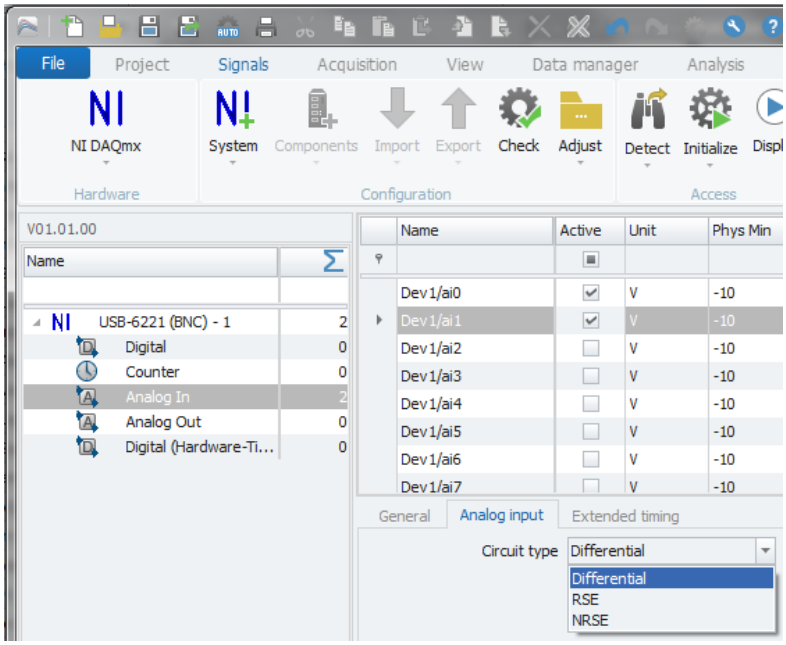
4.1 Device overview

The channels in IPEmotion are grouped in the same structure as on the board. For example, the USB BNC 6221 board has the following channel configuration:

- 8 x differential BNC analog inputs (16-bit, 250 kS/s)
- 2 x BNC analog outputs (16-bit, 833 kS/s),
- 8 x BNC digital inputs (hardware-timed)
- 16 x BNC digital inputs
- 2 x BNC 32-bit counters



4.2 Analog Inputs



All analog inputs operate with the same sampling rate. When defined on one channel, it is automatically udpated on all other channels.

Information

Please note that the maximum sampling rate depends on the active channel count. This results per channel from the maximum sampling rate divided by the channel count. The more input channels are active, the less sampling rates per channel are possible.

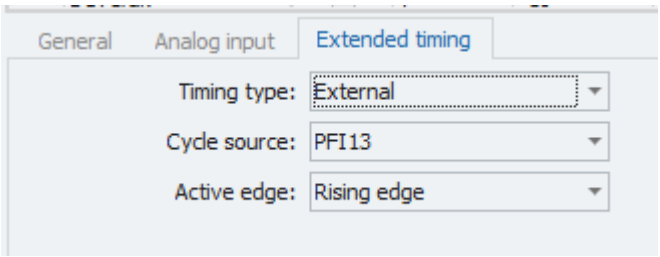
4.2.1 Analog Input Tab

Using the **Analog input** tab, you can define the **Circuit type**. The circuit type defines the type of grounding for the analog input channels. A detailed description can be found in the documentation of the NI DAQmx driver.

4.2.2 Extended Timing Tab

By using the **Extended timing,** tab you can define the following settings:

- Timing type
- Cycle source
- Active edge



There are two different timing types available: internal and external.

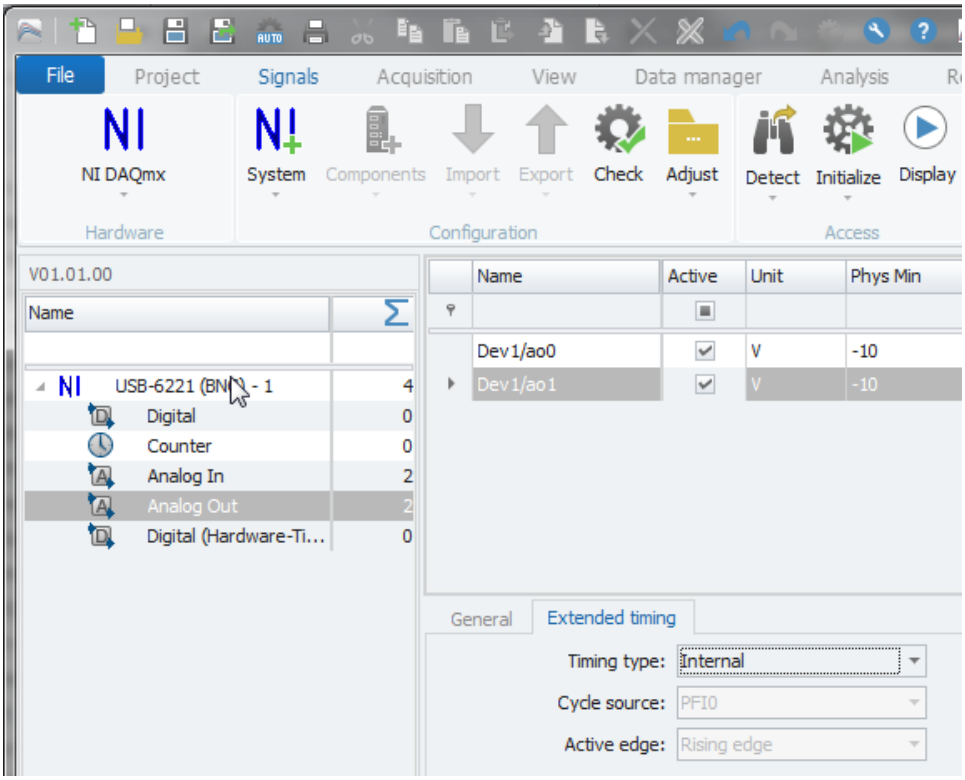
The first type of the **internal** timing uses the frequency defined as sampling rate for generating the samples. The cycle generation runs in the device itself.

The second type of the **external** timing uses the device for generating the samples by using an external cycle. Please note that the sampling rate of the inputs must correspond to the external cycle for avoiding potential synchronization problems between the device and IPEmotion.

The **cycle source** defines the input where the external timing signal is coming from.

The **active edge** defines the time for generating the samples based on a rising edge or falling edge.

4.3 Analog Outputs



All analog inputs operate with the same sampling rate. When defined on one channel, it is automatically udpated on all other channels.

Information

Please note that the maximum sampling rate depends on the active channel count. This results per channel from the maximum sampling rate divided by the channel count. The more input channels are active, the less sampling rates per channel are possible.

4.3.1 Timing tab sheet

There are two different timing types available: internal and external.

The first type of the **internal** timing uses the frequency defined as sampling rate for generating the samples. The cycle generation runs in the device itself.

The second type of the **external** timing uses the device for generating the samples by using an external cycle. Please note that the sampling rate must correspond to the external cycle for avoiding potential synchronization problems between the device and IPEmotion.

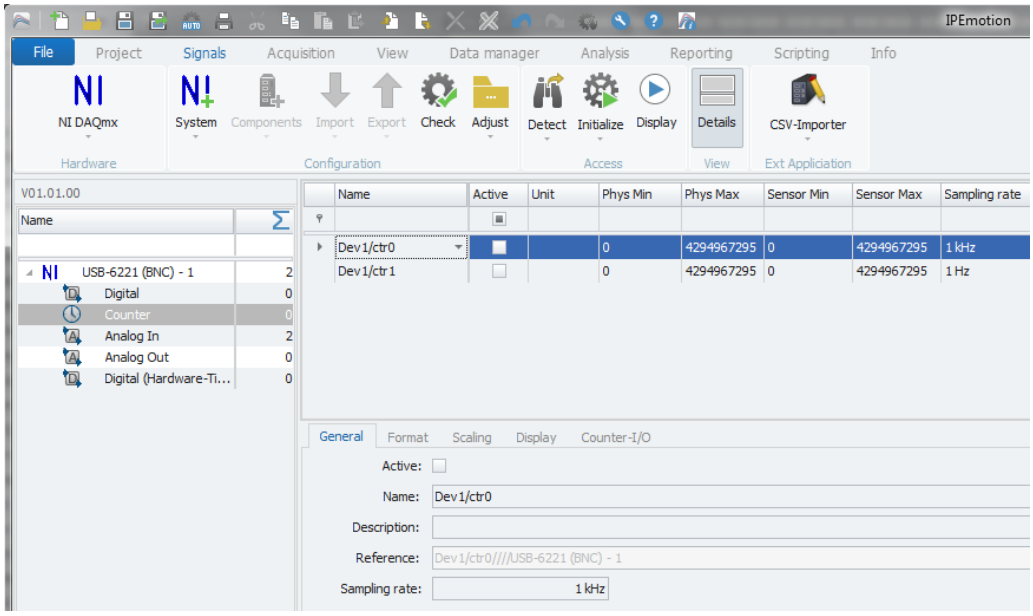
4.3.2 Cycle source

The cycle source defines input and external timing.

4.3.3 Active edge

The active edge defines the time for generating the samples.

4.4 Counter Channels



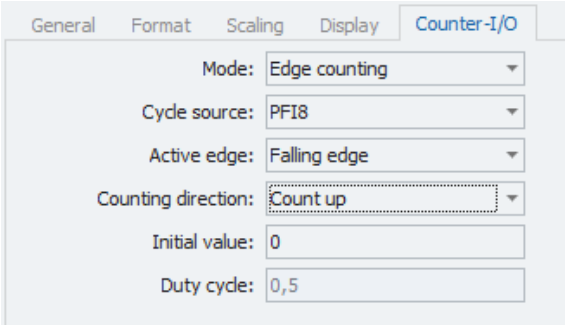
You generally have to distinguish between two different counter types: Whereas the counter of the “USB-6501” can only be used as a software-timed module, the counter of the “USB-6221 (BNC)” can use an external cycle source and therefore offers various definition possibilities.

The software-timed counter uses a software timer based on the sampling rate for periodical sampling.

Each counter channel can use its own sampling rate. The settings are defined on the respective channel itself.

By using the **Counter-I/O** tab, you can define the following settings:

- Mode
- Cycle source
- Active edge
- Counting direction
- Initial value
- Duty Cycle



4.4.1 Mode (Edge counting / Pulse output)

There are two different modes available: edge counting and impulse sequence.

The first mode of **Edge counting** is a common event counter. Since no possible internal cycle generation is available, the counter depends on an external timer if it is not used as a software-timed counter. This cycle defines the frequency for generating and storing the samples.

The second mode **Creating an impulse sequence** uses the counter as output and an impulse sequence can be generated. The sampling rate defines the frequency for generating an impulse sequence. The duty cycle defines the relation between the logical status (Example: A duty cycle of 0.5 corresponds to 50% High level and 50% Low level according to the impulse duration).

Information

The channel type in the Format *tab does not have to be changed separately at changing between edge counting and generation of an impulse sequence because it automatically adapts to the required status.*

4.4.2 Cycle source

In addition to the use of an external cycle source, you have the ability to define the internal timers of the analog inputs and outputs as external timer for the counter. The corresponding descriptions in the drop-down menu are **ai/SampleClock** for analog inputs timer and **ao/SampleClock** for analog outputs. The internal timer of analog inputs and outputs can only be used as external cycle source if the channels are active. This means that at least one channel of this type has to be active and the timer has to be started.

The usage of several analog timers at the same time is limited. A maximum of four resources for every device can access the analog timer at one time. The analog inputs and outputs are already included. Using this limitation, it is not relevant if the timer is one of the analog inputs or outputs.

Information

Please note that the sampling rate must correspond to the external cycle for avoiding potential synchronization problems between the device and IPEmotion.

The external cycle source should not be mixed up with the event counter input. The event counter input differs per device type and can be found in the corresponding device description.

4.4.3 Active edge

The active edge defines the time for sample generation.

4.4.4 Counting direction

The counting direction defines the upward and downward motion of the event counter.

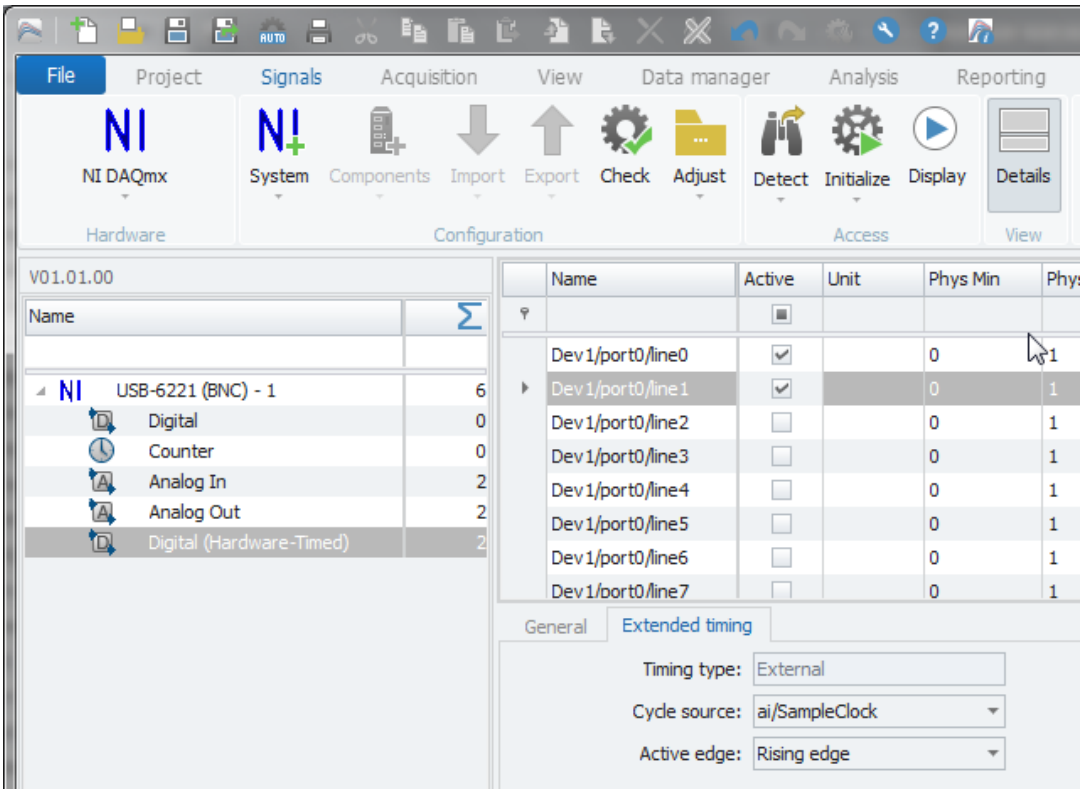
4.4.5 Initial value

The initial value defines the value for counting start.

4.4.6 Duty Cycle

The duty cycle defines the relation between the logical status (Example: A duty cycle of 0.5 corresponds to 50% High level and 50% Low level according to the impulse duration).

4.5 Hardware-timed Digital Inputs / Outputs



In contrast to the software-timed digital inputs and outputs, the hardware-timed channels can access an external cycle source. Timing by using the software timer is not possible.

By using the **Extended timing** tab you can define the following settings:

- Timing type
- Cycle source
- Active edge

4.5.1 Timing type

There are two different timing types available: internal and external.

Internal timing uses the frequency defined as sampling rate for generating the samples. The cycle generation runs in the device itself.

External timing uses the device for generating the samples by using an external cycle. Please note that the sampling rate must correspond to the external cycle in order to avoid potential synchronization problems between the device and IPEmotion.

4.5.2 Cycle source

The hardware-timed digital channels need an external cycle source because they do not have a timing unit. In addition to the use of an external cycle source, you can define the internal timers of the analog inputs and outputs as external timer for the counter. The corresponding descriptions in the drop-down menu are **ai/SampleClock** for the analog inputs timer and **ao/SampleClock** for the analog outputs. The internal timer of the analog inputs and outputs can only be used as external cycle source if the channels are active. This means that at least one channel of this type has to be active and the timer has to be started.

The usage of several analog timers at the same time is limited. A maximum of four resources for every device can access the analog timer at one time. The analog inputs and outputs are already included. Using this limitation, it is not relevant if the timer is one of the analog inputs or outputs.

Information

Please note that the sampling rate must correspond to the external cycle in order to avoid potential synchronization problems between the device and IPEmotion.

The external cycle source should not be mixed up with the event counter input. The event counter input differs per device type and can be found in the corresponding device description.

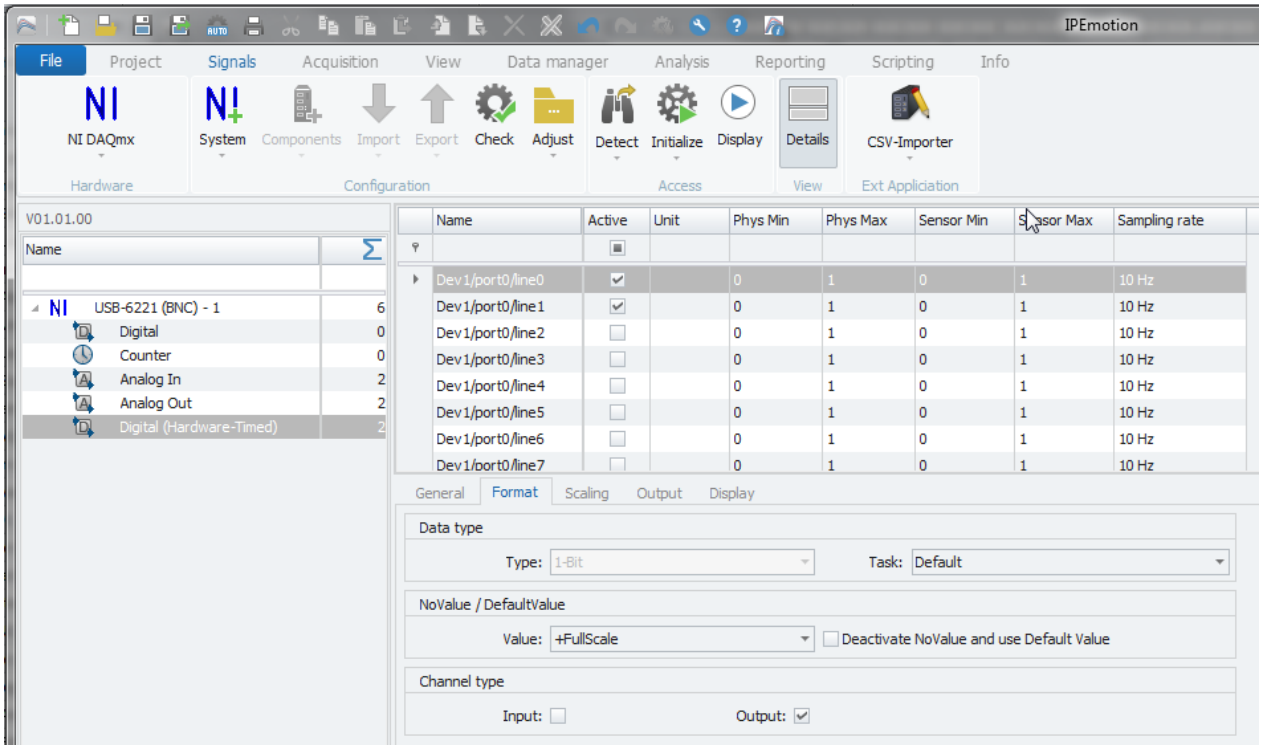
4.5.3 Active edge

The active edge defines the time for generating the samples.

- The same sampling rate is configured for one channel and is automatically applied to all other digital inputs.

Defining data direction:

- The Format tab defines the channel type as an input or output. Over this configuration it is defined whether the channel is operated as an input or output.



5 Explanations for some error messages

This chapter provides information about potential error messages and known behavioral patterns of the NI DAQmx PlugIn.

5.1 Conflict at parallel access to the same resource

Different functions of a device sometimes use the same physical channel. A counter which is defined as an output, physically generates for instance its data on a Digital-I/O channel. If the digital channel is defined as an input and the counter channel as an output, a resource conflict occurs.

You should generally avoid multiple use of physical channels. You can find the respective channel configuration in the data sheet of the corresponding module.

5.2 Sampling rate of analog inputs too high

The possible selection of the analog inputs/outputs sampling rate depends on the number of active channels within a module. Please note in general that the maximum sampling rate can only be selected according to the maximum possible sampling rate divided by the active channel count in the module. “x” indicates the maximum sampling rate, which can be selected with the current configuration.

A possible solution is to reduce the sampling rate or the number of channels.

5.3 General acquisition error or buffer overflow in one x channel

Data storage has been stopped during acquisition due to missing valid data from the device. This often results from a buffer overflow but can also have other reasons. A detailed error description can be found in the send NI error code in the documentation of the NI DAQmx driver.

A possible solution is the selection of a lower sampling rate.

5.4 The sampling rate is invalid

The used software timer runs with a period duration. For limiting the user in selection the sampling rate as less as possible, no fixed values are given but any defined sampling rate is checked for validity. Therefore, the sampling rate must be selected for being converted into a period duration without decimal places. (Calculation: Period duration = 1000/Sampling rate)

A possible solution is the selection of a new sampling rate.

5.5 Maximum 4 channels can operate as analog cycle source

As already described in the chapters above, a maximum of four resources can access the internal timer of the analog channels at one time, otherwise a resource conflict can result.

A possible solution is the access limitation of the analog channels timer to four.

5.6 The acquisition task for the channel type “x” cannot be started

Channels are eventually used by several tasks at the same time. You can find a detailed description of this limitation above under “Conflict at parallel access to the same resource”.

A possible solution is the definition of module and channel settings.

5.7 A synchronization error in the acquisition of channel “x” occurred

A synchronization error in the acquisition of channel “x” occurred. The sampling rate eventually does not correspond to the external timer.

If an external cycle source is used, the sampling rate of the current module/channel has to correspond to the cycle source frequency. If they are not conform, an asynchrony between the device and IPEmotion results and the time stamp of the values does not correspond to the expected times.

A possible solution is the exact customization of the sampling rate to the external cycle.